Redescription of Oxyspirura sturnia
WITH
remarks on its life cycle and host specificity

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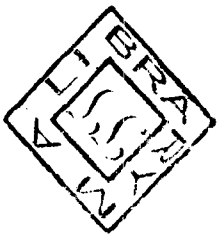
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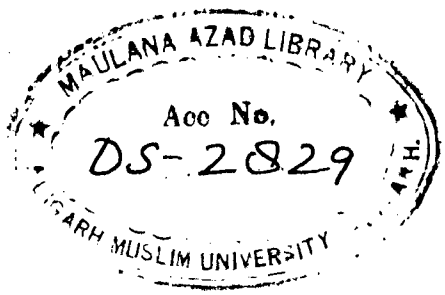
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A C K N O W L E D G E M E N T

The author owes a large debt of gratitude and feels extremely fortunate to have the pleasure of working under the expert guidence and supervision of Dr. Ather H. Siddiqi, who never missed an opportunity to ease my task with appreciative words and actions. I am very grateful to him for the time he devoted to my work.

I gratefully acknowledge and appreciate the efforts of my friends as they have given me encouragement and help of some kind or other at all stages of my work.

S M Alam

(S. M. ALAM)

C O N T E N T S

I N T R O D U C T I O N

The genus Oxysperura Drasche in Stossich, 1897 (Nematoda; Thelazidae) contains a large number of species. As much as 24 new species have been described from India alone, 2 by Singh (1948), 9 by Ali (1960), 8 by Sultana (1964), and 1 by Siddiqi & M.S. Jairajpuri (1964). Recently Oliviera Rodrigues (1962, 1963) added 5 more new species from Brazil and Barus (1963, 1965) described 2 species, one from U.S.S.R. and the other from Czechoslovakia.

Ali (1960), Rasheed (1960) and Barus (1963) reviewed the history, taxonomy and relationship of the genus Oxyspirura and each provided a key to its species. Since the publication of these papers several new species have been described but since than there has been a difference of opinion regarding the validity of the various sub-genera. Yeh (1957) expressed doubt about the validity of the three sub-genera Oxyspirura viz., Oxyspirura Skrj, 1931, Cramispirura Skrj, 1931, Yorkespirura Skrj, 1931, Whereas Barus (1963) added two more sub-genera, Caballeroispirura and Skrjabinispirura. The latter two were rightly suppressed by Siddiqi and M.S. Jairajpuri (1964) who also raised Yorkespirura to generic rank on the basis of its having a divided

buccal capsule. Rodrigues and Frietas (1964) examined type specimens of the type species, Oxyspirura cephaloptera (Molin, 1860). Stossich, 1897 kept in the Vienna museum and found that the buccal capsule is distinctly divided; Consequently, they have transfered all the species of the sub-genus Yorkespirura to Oxyspirura and described the former as synonym of the latter. According to these authors, the genus Oxyspirura is divided into two sub-genera; Oxyspirura including species which may or may not have a divided buccal capsule but having markedly unequal and dissimilar spicules; Cramispiruraincluding species with undivided buccal capsule and having equal or sub-equal spicules. Rodrigues (1964) also raised Cramispirura to the rank of the genus on the basis of above character and added 4 more species of Oxyspirura in the list of the species already described under Cramispirura

D.S. Jairajpuri and Siddiqi (1967) considered the character of equal or sub-equal spicules in Cramispirura as valid for generic rank if there were distinct difference in the spicule ratio within the species of the two groups.

Molinospirura a new genus was suggested by Rodrigues (1964) on basis of cuticular projections arising from the base of the anterior region of the buccal capsule but D.S. Jairajpuri and Siddiqi (1967)

suppressed the genus and did not consider the above character as of any generic importance, the reasons that they have given is that any separation in genus at the sub-generic or generic level should be based on the divided or undivided nature of the buccal capsule and not on a mere cuticular projections arising at the base of the buccal capsule.

From the above statement, it could very well be understood that different workers have different opinions regarding the specific characters on the basis of which a new species is described. Recently D.S. Jairajpuri and Siddiqi (1967) described 14 new species from India but the description of most of them was based on a fewer number of specimens, sometimes on a single male specimen. In the present investigation an attempt was made to collect some of those species from the type host and type locality and extend the description of Jairajpuri and Siddiqi (1967).

In the present study the new species Oxyspirura sturnia, D.S. Jairajpuri and Siddiqi 1967 was selected. This parasite lives in the orbital cavity of Sturnus contra L, Taccocua leschenaultii Lesson, Acredotheres giginianus (Latham), and Francolinus pondicereanus. The morphological description of this species was based on 5 males and 6 females. However no experimental

observation was made on the host specificity of this parasite, (although it has been reported from 4 different hosts).

Ali (1960) described that the genus Oxyspirura is very host specific and usually each host has its own species of nematode. Therefore it was felt necessary to carry out some experiments on the host specificity of this parasite which apparently posses a loose host specificity. Attempts were also made to find out the life cycle patterns and the possible intermediate host (s) involved.

In the following work, a redescription of the species have also been provided so as to examine any intraspecific variations within the type locality (Aligarh). The frequency and total incidence of infection has also been established.

MATERIAL AND METHOD

A number of birds belonging to the genus and species Sturnus contra were collected from various places in the type locality and brought to the laboratory. These birds were then carefully examined and identified. First of all the parasites were traced below the nictitating membrane with the help of a fine brush and a pair of foreceps (without desecting the eye) and the parasites isolated in this manner were put in the physiological saline in a cavity block. After performing this the eye regions was desected out carefully. The eye balls were removed without causing any damage to them and were put in a petridish containing physiological saline and the rest of the skull was put in another petridish so as to locate the parasite remaining hidden or embedded in the musculature of the orbital chamber.

It was observed that the parasites might inhabit the exposed portion of the eye or it might remain lying behind the eye ball or even it might be found embedded in the muscles of the eye chamber.

PREPARATION OF SLIDES FOR MORPHOLOGICAL STUDY:

Some of the parasites isolated in the manner given above were then killed by putting them in hot (70 ^{o}C)

physiological saline and then transferred to glycerene alcohol. After passing through increasing concentrations of glycerene alcohol, slides were prepared by mounting the parasite in pure glycerine. They were then carefully studied under the microscope for their various characteristics. The characteristic features found in this study were then compared with those previously described by D.S. Jairajpuri and Siddiqi (1967).

LIFE CYCLE STUDIES:

Some of the females of O. sturnia were disected out and eggs were isolated from their uteri so as to observe the embryonic development. For this purpose the eggs were put in three cavity blocks. In the first, the eggs were put in the normal saline, in the second cavity block 0.1% formalin solution was added while in the third cavity block the eggs were put in Sodium azide solution. This was done to protect the eggs from any possible fungal infection.

Three different insects i.e. Tribolium confusum, Periplanata americana and dung beetles were collected and the eggs were fed to them in the following manner.

The above possible experimental intermediate hosts were first put to starvation for one week. After the

starvation period, they were allowed to feed on a small piece of apple at which the eggs were already put so as to induce the infection into their body. These insects were then provided with their regular normal food to enable them to live for a considerably longer period under the laboratory conditions. These insects were then autopsied after 5 day intervals for 50 days and were then minutely examined under the microscope.

DESCRIPTION: (Based on 20 Males and 25 Females)

Worms filiform, slender, anterior end rounded posterior end tapering, ending in an acute terminus, Broad cephalic alae in the head region 217-231 μ long. Mouth terminal, hexagonal surrounded by sixteen cephalic papillae, 6 inner, 6 median and 4 outer and a pair of amphids situated laterally. Buccal capsule squarish or a little flattened antero-posteriorly, 19-27 μ deep. Nerve ring situated at 0.18 - 0.28 mm from anterior end. Division of glandular and muscular portion of the oesophagus is indistinct.

MALE: (Fig.1a.1b).

Body length 4.7 - 7.8 mm, width 0.16 - 0.22 mm, total length of oesophagus 0.503 - 0.520 mm, tail 0.16 - 0.28 mm curved ventrally and tapering to a fine

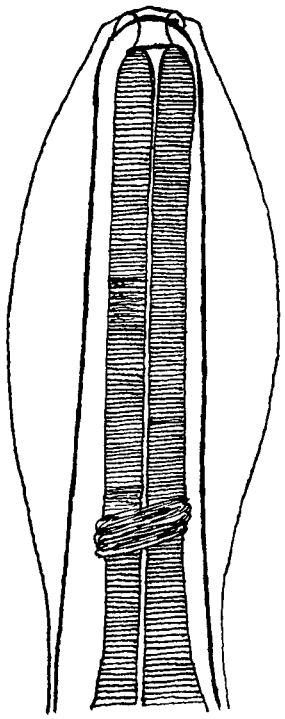

Fig.1 (a) ANTERIOR END OF MALE

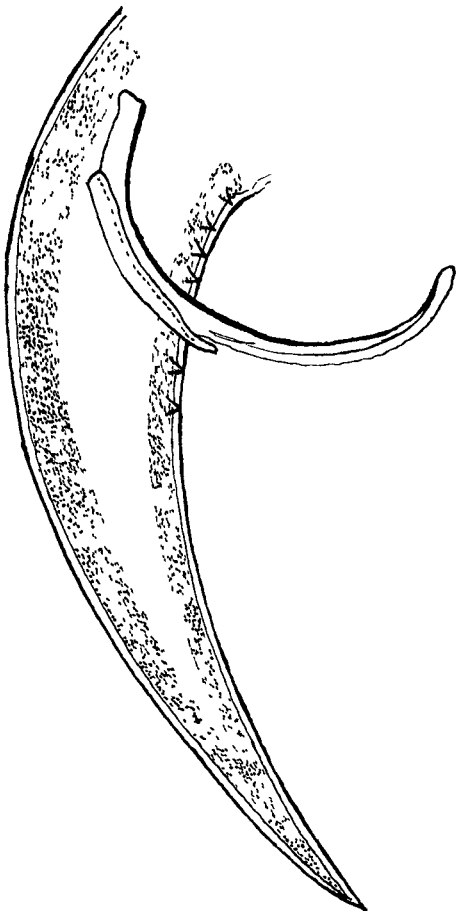

Fig.1 (b) POSTERIOR END OF MALE

point. Testis extending to two thirds of body length, then reflexed, cloacal papillae sessile, 4 pairs precloacal, 2 pairs post cloacal, spicules slender, similar, unequal, proximal,end of spicules cephalate; right one 0.129 - 0.131 mm, left one 258.4 - 270 mm; spicule ratio approximately 1 : 2 , Gubernaculum prominent, delicate and saddle - shaped.

FEMALE: (Fig. 2a,2b,2c).

Body length 6.4 - 8.9 mm, width 0.27 - 0.32 mm total length of oesophagus 0.72 - 0.78 mm, length of cephalic alae 217 - 224 μ, tail 0.23 - 0.28 mm, tapering to a fine tip, A pair of caudal papillae at 0.116 - 0.140 mm from tip of tail, vulva a transverse slit, at 0.42 - 0.58 mm from posterior end, vagina a muscular tube ascending anteriorly, uteri volumenous, packed with numerous embryonated eggs, Eggs 40 - 42 x 24 - 28 μ in size.

REMARKS:

Variations were encountered mainly in the size of the body, shape and size of the buccal capsule and in the length of cephalic alae, the features which were considered by D.S. Jairajpuri and

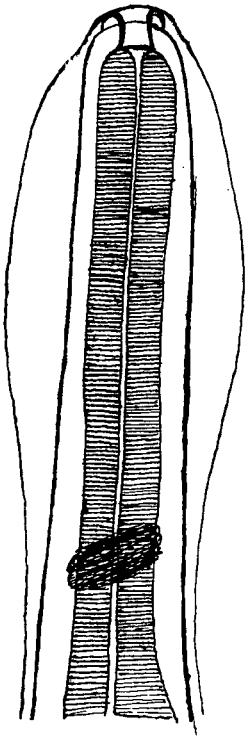

Fig.2(a) ANTERIOR END OF FEMALE

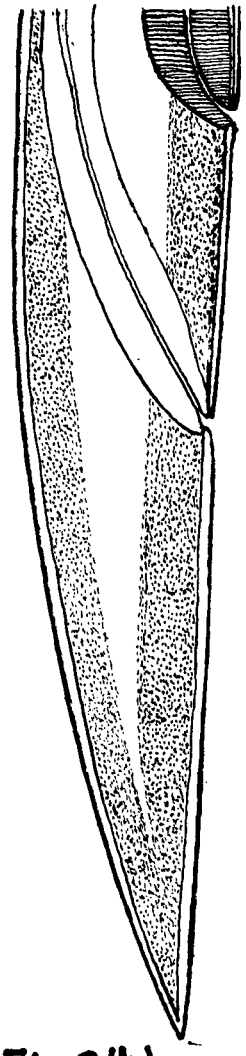

Fig.2(b) POSTERIOR END OF FEMALE

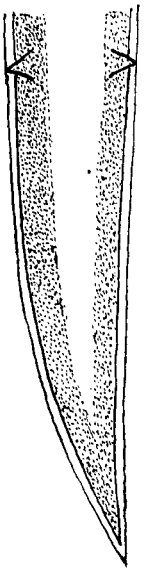

Fig.2(c)
TAIL END OF FEMALE
SHOWING CAUDAL PAPILLAE

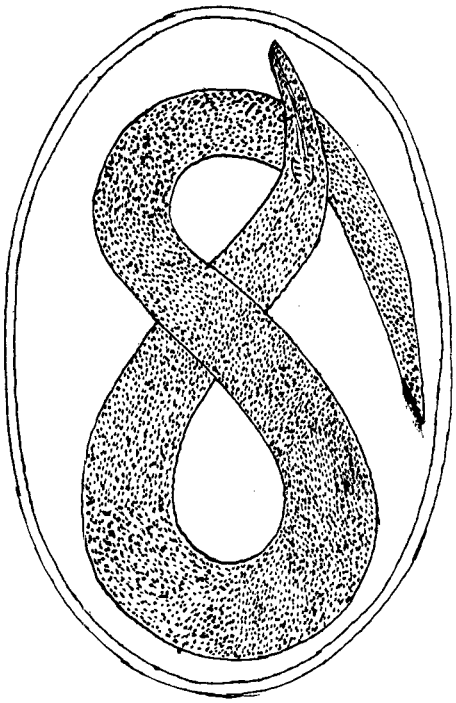

Fig. 3. EGG CONTAINING EMBRYO

Siddiqi (1967) as some of the basic characterstics on the basis of which this new species was erected. However, the other features like the number and location of the cephalic papillae, shape of the body, number and position of the cloacal papillae; caudal papillae in females, size and ratio of the two spicules and presence of a prominent gubernaculum in males is found constant.

TRANSFER EXPERIMENTS

Previously no attempt has been made to determine the host specificity of Oxyspirura sturnia although it was reported from 4 different hosts (D.S. Jairajpuri and Siddiqi, 1967) and as Ali (1960) described the genus Oxyspirura to be highly host specific, it was necessary to conduct the transfer experiment to determine as to whether the parasite is strictly host specific or not.

To perform the transfer experiment, 6 days old chicks were chosen. The parasites were collected from the eye of Sturnus contra and transferred swiftly into the eye of the experimental host (chicks) with the help of a hair brush, they were then autopsied at 6 hour intervals.

R E S U L T S

LIFE CYCLE STUDIES

(a) The eggs did not show any significant development under laboratory conditions.

(b) When the insects which were exposed to *nematode eggs were autopsied, they were found to* harbour neither the eggs nor any of the developmental stages. In this way, it is proved that the above insects are not the true intermediate hosts, while in the case of O. manosoni it was found by Fielding (1926-'28) and Sanders (1928) that cockroach (Pychoscellus surinamensis) acted as experimental intermediate host in which the eggs could develop and the infective larval forms were obtained after 50 days from the alimentary canal of the cockroach either lying in the intestine or encysted on the outer layer of the inestinal wall.

INCIDENCE OF INFECTION

The total incidence of infection in the type locality is 36.2% but it varies in the different parts of the type locality from 20% - 66% . Infection decreases during extremely hot weather, generally in the month of June, during the months of spring

TABLE I

INCIDENCE OF INFECTION OF *OXYSPIRURA STURNIA* IN *STURNUS CONTRA*

S.No.	Date	Locality	Number of Birds Examined	Number of Parasites Recovered		No. of Infected Birds	Incidence of Infection in each Locality	Mean Number of Parasites in each bird
				♂	♀			
1.	15.3.'76	Kwarsi (Alig.)	4	2	3	2	50%	2.5
2.	28.3.'76	Khatauli & Agra Rd.	10	4	7	3	33%	3.3
3.	30.3.'76	M.U. Campus	6	2	1	2	33%	1.5
4.	8.4.'76	Kwarsi (Alig.)	7	1	2	2	31%	1.5
5.	20.4.'76	Ramghat Rd.Alig.	5	1	-	1	20%	1.0
6.	7.6.'76	Bhamola	6	4	2	4	66%	1.5
7.	8.6.'76	Jamalpur	9	3	6	3	33%	3.0
8.	9.6.'76	Botanical Garden	7	3	4	4	57%	1.7
			58	21	25	21	36.2%	

season, there is no considerable variation in the incidence of infection.

The mean number of parasites obtained from each bird is variable but never exceeded 5 and 3 from each eye. This is probably due to the delicate nature of their habitat.

The results of the data on the incidence of infection are shown in Table No. I.

TRANSFER EXPERIMENT

The parasites could not be traced through out the alimentary canal (after 6 hours) of the experimental host but the presence of a few number of eggs in various regions of the alimentary canal was suggestive that the parasite had migrated through it and perished in the unnatural habitat.

Table No. II shows the experimental observation on transfer experiments.

T A B L E II

RESULTS OF EXPERIMENTS WITH OXYSPIRURA STURNIA WHICH WERE TRANSFERRED TO THE EYES OF WEEK OLD CHICKS.

S.No.	No. of Parasites Transferred into the eye of each Chick		Age of the Chick at the time of Transfer	Interval of Time at each Autopsy	Remarks
	♂	♀			
1.	2	3	6 days	6 hrs.	Present in the same eye.
2.	2	3	"	12 hrs.	Absent throughout the alimentary canal.
3.	2	2	"	18 Hrs.	Parasite absent but few eggs in the gizzard contents only.
4.	1	2	"	24 hrs.	Eggs present in the intestinal contents.
5.	1	1	"	30 hrs.	Few eggs present in the Rectal contents.

D I S C U S S I O N

In the present study the incidence of infection was found to vary at different places of the type locality from 20% - 66%. It also varies greatly in different seasons. The infection among the type host was recorded more in the months of March and April but from mid May onwards, i.e. to the last week of June, it decreases considerably. The decrease in the incidence of infection in the month of June when extreme hot weather prevails is probably due to the non availability of the suitable intermediate host which may be insects or small crustaceans as concluded from the gut contents of the type host. Sturnus contra obtain its food generally from the nearby ponds, ditches etc and as these water bodies start drying out in the hot weather when the mercury touches the 40 - 45 °C mark, Secondly the dessication of the thin walled eggs may take place ultimately lowering the rate of infection.

Such factors i.e. non availability of the intermediate host and dessication of eggs, may be restricting the incidence of infection but these views are purely speculative and some other or more factors may be involved.

The most important fact to denote here is that infected birds were never found to have more than 5 parasites at a time and not more than 3 in one eye. This is probably due to the less nutritive value of the eye or lack of availability of space to live therein. Moreover if the numerical strength of the parasite increases it may interfere in the normal functioning of the eye. The damage to the eye might result in the death of the host. It is obviously to the disadvantage of the parasite to cause death of its host, for in so doing it destroy itself.

As far as the life cycle of O. sturnia is concerned the eggs were observed under the microscope and were found to have completely formed larvae in the form of the figure of '8'. (Fig.3) This shows that the parasite releases the eggs with fully developed larvae in the body of its host, which ultimately passes out with the faeces of the host.

To findout the possible intermediate host the eggs were fed to the three types of insects i.e. Tribolium, Cockroaches and dung beetles, Then they were autopsied after 5 day intervals for 50 days but neither the eggs nor any of the developmental stages were found, from the results reported above this could be established that the experimental

intermediate hosts were not the suitable intermediate hosts for this parasite.

Considerable intraspecific variation are found to exist among these particular eye worms, In the previous description of O. sturnia this could not be established because the description was based on only a few specimens. In the present study a number of specimens (20 males and 25 females) were collected. Variations were found mainly in the total body length, size and shape of the buccal capsule (Squarish - anteroposteriorly flattened), although there were variations in other characters also but these were proportionately constant with respect to body length and hence may considered to be similar e.g. total length of oesophagus in males is 0.73 - 0.8 mm (D.S. Jairajpuri and Siddiqi, 1967) but in my observations it is 0.503 - 0.520 mm, such a vast difference when considered with respect to the total body length appears insignificant as the value of b comes out to be same in both cases.

In my opinion the variations encountered are of minor significance and should be considered as intraspecific. Thus I place the species collected from the type host and type locality in the genus

Oxyspirura and species sturnia.

Ali (1960) described the genus Oxyspirura as highly host specific and the parasite host list provided in the review of the genus by D.S. Jairajpuri and Siddiqi (1967) clearly shows that out of 71 valid species recorded under the genus - 56 (79%) are one host species, 4 (56%) two host, 2 (2.8%) three host, 2 (2.8%) four host, 1 (1.4%) five host and 6 (8.4%) are several host species. Keeping in mind the high degree of host specificity of the genus Oxyspirura and secondly the apparent loose host specificity of O. sturnia as it was reported from four different types of birds, transfer experiments were carried out.

To study the host specificity, chicks were selected because they are more succeptible to the infection. This experimental host was used with the assumption that parasite should establish in this host also if it has loose host specificity because it was reported from four different and unrelated birds but the parasite failed to establish. Autopsy of chicks after 6 hour intervals upto 30 hours showed that the parasite transferred were present after 6 hours in the same eye but they disappeared thereafter and could not be traced throughout after 30 hours. The presence of the eggs along the alimentary canal

indicate that the parasite migrated into the alimentary canal (most probably through the nasopharyngeal passage) and was digested there and was ultimately eliminated in the faces. The above facts show that the parasite is very much host specific although it is a four host species.

The second presumption in observing the host specificity experimentally was that the physiology of the eye is similar in of the parasite in the eye of the experimental host also show that probably some physiological difference does exist in the eyes of different birds which hinders the establishment of the parasite. Quite contrary is the case with the trematode Philopthalmus which when transferred from its definitive host to any experimental animal, established itself in the eye of the new host. These two contradictory conclusions may be due to the degree of host specificity of the parasites. concerned. O. sturnia is more host specific and therefore fails to develop in other experimental animal while Philopthalamus is capable to adapt itself in a variety of hosts.

The paper by D.S. Jairajpuri and Siddiqi (1967) in which 14 new species have been described from India provides an excellent key to the species of

Oxyspirura and an up-todate host parasite list. The diagnostic data is helpful although certain characteristics show a very limited degree of variations a feature, which does not conform with the more variable characteristics encountered in O. sturnia in the present work.

The description of 7 out of 14 new species by D.S. Jairajpuri and siddiqi (1967) are based on single specimens (male). With the exception of cloacal papillae other characters of these specimens show minor variations. It may thus be assumed that the number and arrangement of the cloacal papillae is the major character taken into consideration while describing these species. As O. sturnia shows a wide range of variations, description of these species should also be based on a large number of specimens to establish the complete degree of variation within the species. Therefore recollection and redescription of those species based on single or a few specimens, is essential.

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